# PRODUCTION, COST AND INCOME DISTRIBUTION OF THE ELECTRIC SUPPLY INDUSTRY IN PRE-WAR JAPAN*

*By* RYOSHIN MINAMI

*Lecturer, Institute of Economic Research*

## I. *Introduction*

The purpose of this paper is to clarify the growth process of the electric supply industry[1] in pre-war Japan from the three aspects of production, cost and income distribution.

The history of the industry dates from 1887. Since then this industry grew rapidly along with the nation's economic progress. This rapid progress in the early stage continued up to the end of the 19th century. In those days steam power generation was dominant and the major part of the electricity was supplied to ordinary homes for illuminating purposes.

The full-scale progress of the electric supply industry started after the end of the Russo-Japanese War (1904–5). Due to the technological progress represented by the remarkable increase of hydraulic generators and the success of long-distance high tension transmission, the electric supply capacity increased greatly. This resulted in increasing the demand for electricity through a decline in the price of electricity. Meanwhile, the transition from steam power generation to hydraulic generation and from light demand to power demand became even more decisive.

Since World War I (1915–6), however, an oversupply of electricity gradually appeared and the electric supply industry went into an era of excessive competition; the price of electricity was lowered and the profit of the industry decreased. This tendency became decisive during the Panic (1930). As a countermeasure to cope with this situation, the electric supply industry organized an electric power cartel in 1932, and ended electric supply dumping. Finally, in 1942, it was placed under national control.

All data necessary for the analysis have been estimated and calculated by the writer using *Denki Jigyō Yōran* (*Electric Supply Industry Manual*).[2] As the statistics date back to 1907, our analysis covers the period from 1907 to 1941 which precedes the year when the industry was placed under national control. This period includes the most important part of the history

* The work of putting this paper into English was supported by the Ford Foundation as part of a project promoting the translation of Japanese economic studies.

This is an English translation of the outline of the following article which has already been published. ("On the Growth of the Electric Supply Industry in Pre-War Japan" (in Japanese), *Keizai Kenkyu* (*The Economic Review*) Vol. 14, No. 4, Oct. 1963).

[1] Among the pre-war enterprises belonging to the electric supply industry, there were some companies which operated electric railways at the same time. These are omitted because they do not fall under categories of the present analysis.

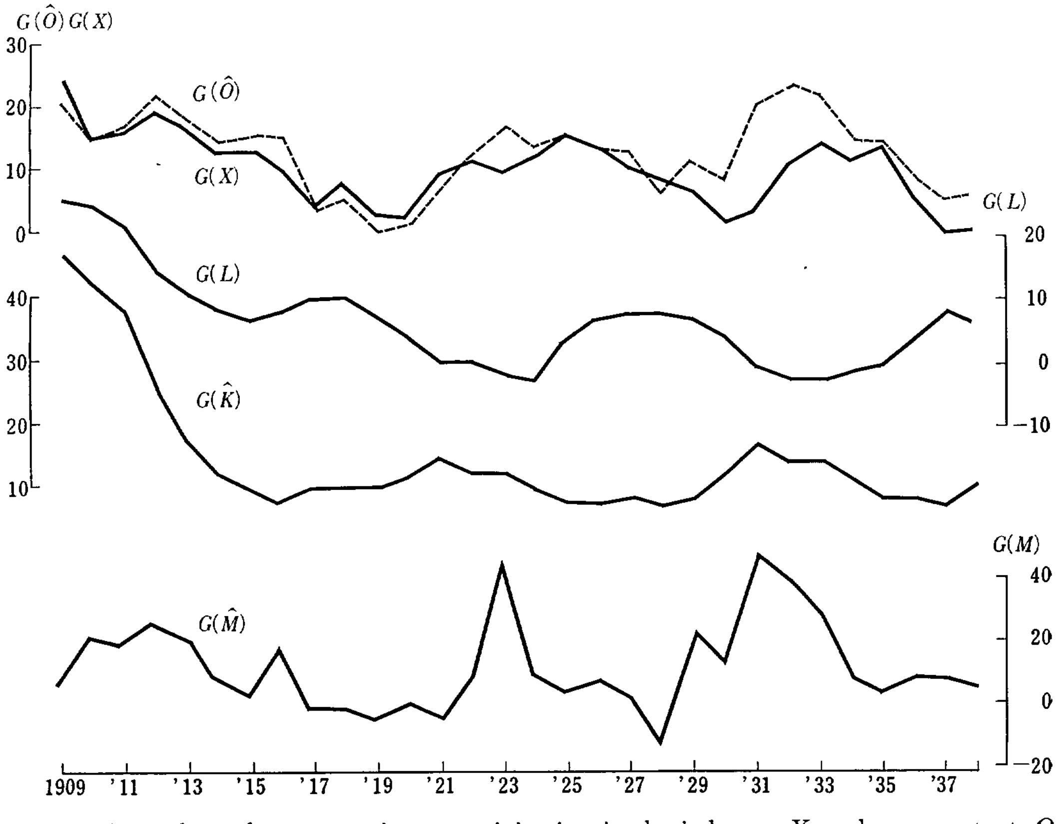
[2] As for the method and result of the estimation and calculation, see "On the Growth of the Electric Supply Industry."

of this industry. However, in consideration of the errors in the estimation and calculation, we will use 5 years moving average series.

## II. *Analysis of Production*

First of all, let us find out how the input and output of this industry changed during its growth process. Chart 1 shows the process of change in the growth rate (shown by $G(\ )$).

CHART 1. GROWTH RATES OF INPUT ($L, \hat{K}, \hat{M}$) AND OUTPUT ($\hat{O}, \hat{X}$) (%)




As the indices for output, income originating in the industry, $X$, and gross output, $O$, are, used. $X$ is the residual of $O$ after interest $Z$, direct tax $T$, fuel cost $M$ and depreciation cost $D$ are deducted, and is the total of the paid wages (including salaries) $W$ and the profit. The ratio between $X$ and $O$ is called the income ratio and is indicated by $\eta$.

$$\eta=\frac{X}{O}$$

$\hat{X}$ and $\hat{O}$ in Chart 1 are the series of $X$ and $O$ deflated respectively by the elecricity price index (1934=100). In the early stage $G(\hat{X})$ shows an extremely high level of more than 20% and since then gradually decreases. This decrease stopped in 1920 marking the bottom of the growth rate. As has been stated before, this period was the time when the industry achieved its most rapid progress.

We can find a clear cycle in this growth rate. Peak $P$ and bottom $B$ change as follows

| | |
|---|---|
| $B$ | 1920 |
| $P$ | 1925-6 |
| $B$ | 1930 |
| $P$ | 1933-5 |
| $B$ | 1937-8 |

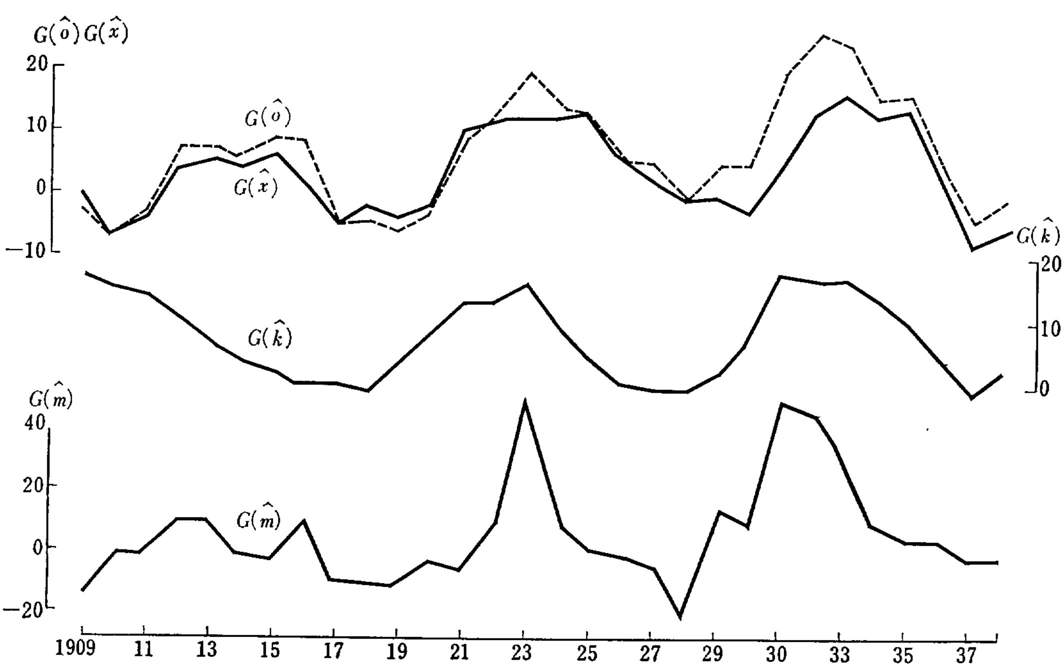
These figures show that a cycle of about 10 years took place in this growth rate. What is the reason for this cycle? In this connection, let us see the change in $G(\hat{O})$. It can be seen that there is an intimate relationship between $G(\hat{X})$ and $G(\hat{O})$. The change in $G(\hat{O})$ is closely related to the business cycle. The bottom of $G(\hat{O})$ corresponds to the depression and its peak means the boom period. This fact shows that electricity demand $\hat{O}$ is considerably influenced by economic changes.

The problem we are concerned with here is how the pattern of the growth rate is backed up by the pattern of the changes in labor and capital. In short, it is to find out the relationship between the growth rates of output and those of input.

Chart 2 was prepared for this purpose. Net output per manhour is indicated by $\hat{x}$.

$$\hat{x}=\frac{\hat{X}}{L}$$

CHART 2. GROWTH RATES OF LABOR PRODUCTIVITY ($\hat{o}, \hat{x}$) AND FACTOR RATIOS ($\hat{k}, \hat{m}$) (%)




From this, we obtain

$$G(\hat{X})=G(L)+G(\hat{x})$$

Let us compare the two curves of $G(L)$ in Chart 1 and $G(\hat{x})$ in Chart 2. From this comparison, the following can be found. In the first place, in the expanding period ending in 1920, $G(L)$ is greater than $G(\hat{x})$. Since then $G(\hat{x})$ is greater on the average. In the second place, these rates of increase indicate a cycle of 10 years.

The first fact shows that the rapid progress of the industry in the early stage was mostly the result of the increase in labor rather than the increase in productivity; in other words, that the progress of this industry was "horizontal". After the termination of this period, progress was brought about by productivity increase or technological progress rather than anything else. This fact is reflected by the change from steam power generation to hydraulic generation.

It is presumed that the growth rate for labor productivity has a naturally close relationship with that of capital intensity $\hat{k}$

$$\hat{k}=\frac{\hat{K}}{L}$$

Here $\hat{K}$ is the capital stock in 1934 price. From this definition, the following is obtained

$$G(\hat{K})=G(L)+G(\hat{k})$$

$G(\hat{K})$ is drawn in Chart 1 and $G(\hat{k})$ in Chart 2.

First of all, let us compare $G(\hat{K})$ with $G(L)$. In the expanding period ending in 1920, $G(L)$ is greater than $G(\hat{k})$ and since then $G(\hat{k})$ is greater on the average. In other words, the rapid enlargement of capital stock in the expanding period (in the first year of the analysis period, the growth rate was more than 40%) was mostly realized by capital widening, and since then capital deepening played a big part. The fact refletcs the change from steam power generation to hydraulic generation.

Next, $G(\hat{k})$ is compared with $G(\hat{x})$. The patterns of these two curves are very much alike. This fact suggests that productivity can be very well explained by the degree of capital intensity.[3]

In Chart 2 the growth rate of gross output per man hour $\hat{o}$ is drawn.

From
$$\hat{o}=\frac{\hat{O}}{L}$$
$$G(\hat{O})=G(L)+G(\hat{o})$$

is obtained. $G(\hat{o})$ moves in about the same way as $G(\hat{x})$. This is the natural result of the fact that the patterns of the changes in $G(\hat{O})$ and $G(\hat{X})$ are the same. Since there is an intimate relationship between $G(\hat{o})$ and $G(\hat{x})$, and interrelationship between $G(\hat{o})$ and $G(\hat{k})$ is also clearly found.[4]

At the bottom of Chart 2 the growth rate of the real value of per manhour fuel consumption $\hat{m}$ is drawn.

From
$$\hat{m}=\frac{\hat{M}}{L}, \text{ we obtain}$$
$$G(\hat{M})=G(L)+G(\hat{m})$$

---

[3] The following relationship has been measured between $\hat{x}$ and $\hat{k}$

$$\log \hat{x}=-0.49744+0.63902 \log \hat{k} \qquad r^2=0.92389$$
$$(0.03406)^*$$

If the position of the co-ordinates is changed, the mutual relationship is even more improved.

$$\log (\hat{x}-0.2)=-0.79713+0.88795 \log \hat{k} \qquad r^2=0.92462$$
$$(0.04708)^*$$

(* shows that the parameter is meaningful at the significance level of 5%)

[4] $$\log \hat{o}=-0.46607+1.01987 \log \hat{k} \qquad r^2=0.93414$$
$$(0.05029)^*$$

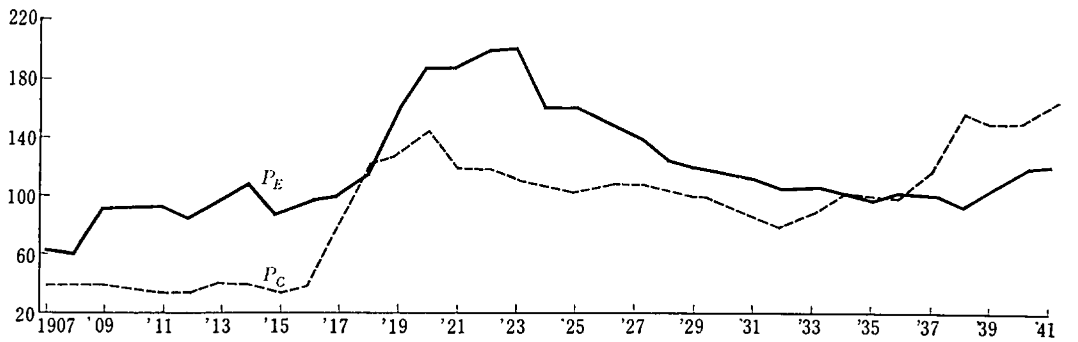
The fuel consumption concerns almost wholly steam power generation. Since there was a great change in steam power generation, $G(\hat{m})$ shows a great change in comparison with $G(\hat{o})$. This change was more than 40% in 1923 and 1931, and −20% in 1928. However, the cycle of $G(\hat{m})$ almost perfectly coincides with that of $G(\hat{o})$.[5]

In the early part of our period, steam power generation constituted the major part of electric power generation. Hydraulic generation, however, gradually increased and in the latter part of the 1920's, sterm power generation started to be placed in the auxiliary position of supplementing the shortage caused by the increase in demand or lack of water in hydraulic generation. Therefore, in the period when electricity demand increases, hydraulic generation rapidly increases. Such was the reason why fuel consumption rapidly increased in 1923 and 1931. And it was actually shown in the change in $G(\hat{O})$, electricity demand greatly expanded in these two years.[6]

## III. *Analysis of Cost*

Here we will examine the changes in the income ratio $\eta$.[7] The $\eta$ curve shown in Chart 3 decreases from the long-run viewpoint accompanied by several short-run changes. In the beginning of the analysis period, this was about 75%, but less than 30% in the final year. In other words, the income ratio decreased more than half within 35 years.

CHART 3. THE MOVEMENTS IN THE ELECTRIC PRICE INDEX ($P_E$) AND THE WHOLESALE COAL PRICE INDEX ($P_c$) (1934=100)




[5] $\log \hat{o}=0.52130+0.99795 \log \hat{m}$ $\quad r^2=0.93107$
$\quad(0.05042)^*$

It has been found that there is a mutual relationship between $\hat{o}$ on one hand and $\hat{k}$ and $\hat{m}$ on the other hand.

Next, an equation with 2 variables of $\hat{k}$ and $\hat{m}$ is measured

$$\log \hat{o}=0.01709+0.54461 \log \hat{k}+0.51730 \log \hat{m} \quad r^2=0.98146$$
$$(0.06238)^* \qquad (0.01935)^*$$

[6] It is desirable to analyse production or to measure the production function separately for hydraulic generation and steam power generation. However, it is impossible to do so in view of the data available.

[7] There is an estimate of income ratios by industry for 1930. According to this, that of the electric supply industry is predominantly high compared with those of other industries. Yuzo Yamada (ed), *Statistics for Estimates of National Income in Japan*, (in Japanese), Tokyo, 1957, p. 55.

The important thing is that this fact took place inspite of the increase of weight in hydraulic generation which was high in its income ratio.[8] This suggests that the respective income ratios for both hydraulic generation and steam power generation rapidly decreased.

One of the reasons for the decreasing trend in the income ratio was the increase in interest payments. In this connection, we want to point out two things.

The first is the fact that during this period hydraulic generation, which required a huge equipment investment, became predominant.[9] The huge fixed investments due to the increase in hydraulic generation could not be borne by the enterprises' own capital, and thus bonds and loans increased. The second is the fact that, as explained before, supplementary steam power generators were constructed in cities in order to meet the shortage. These facts swelled up interest expenses.

In the same Chart the net added value ratio $\lambda$, the percentage of the net added value $Y$ to gross output $O$, is drawn.

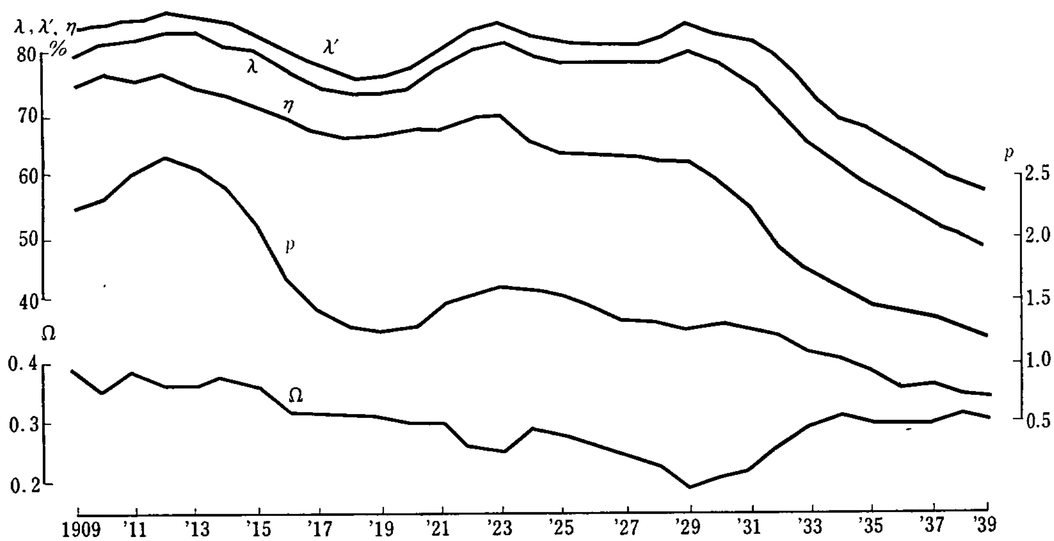
$$\lambda=\frac{Y}{O}$$

Since $Y$ is the balance of $O$ after deducting $M$ and $D$, the following is the relationship with $X$

$$X=Y-(Z+T)$$

Therefore we get

CHART 4. THE MOVEMENTS IN ADDED VALUE RATIO ($\lambda'$, $\lambda$), INCOME RATIO ($\eta$,) ELECTRICITY-COAL RELATIVE PRICE ($p$) AND THE RATIO OF FUEL CONSUMPTION TO OUTPUT ($\Omega$)




[8] It is possible to measure the income ratio separately for hydraulic generation and steam power generation for certain years. In 1912 the income ratio of hydraulic generation was 84% and that of steam power generation was 71%. The reason for the low income ratio of steam power generation is the high fuel cost.

[9] If we look at the structure of the outlay in 1912, we find that the ratio of interest cost in the outlay is predominantly high in the case of hydraulic generation.

$$\eta=\lambda-\frac{(Z+T)}{O}$$

Since it is possible to disregard the direct tax $T$, the difference between $\eta$ and $\lambda$ is about the same as the ratio of interest payment $Z$ to $O$. In Chart 4, it is easy to find that the difference increased year after year. This means a remarkable increase in interest payments.

Next, what are the factors which cause the change in $\lambda$? The first thing we can think of is the increase in depreciation cost. This is because the increase in equipment raises not only interest cost but also depreciation cost. The gross added value including depreciation cost is indicated by $Y'$.

$$Y=Y'-D$$

The ratio of $Y'$ to $O$ is called the gross added value ratio and is indicated by $\lambda'$

$$\lambda'=\frac{Y'}{O}$$

In other words,

$$\lambda=\lambda'-\frac{D}{O}$$

The difference between $\lambda$ and $\lambda'$ is the ratio of depreciation cost to gross output. According to the Chart, this difference increased from 1930. In other words, the increase in depreciation cost constitutes one of the reasons for the decrease in $\lambda$.

In that case, how can the change in $\lambda'$ be explained? $\lambda'$ is independent from $Z$ and $D$. From

$$Y'=O-M, \text{ we obtain}$$

$$\lambda'=1-\frac{M}{O}$$

Since the major part of $M$ is coal consumption, the following will be true

$$\lambda'=1-\frac{P_c\hat{M}}{P_E\hat{O}}$$

In the above $P_c$ is the wholesale price index of coal and $P_E$ is the electricity price index. Now, the relative price of electricity to coal or $P_E/P_c$ is denoted by $p$ and the ratio $\hat{M}/\hat{O}$ by $\Omega$. $\Omega$ indicates how much fuel is required in order to produce one unit of electricity.

$$p=\frac{P_E}{P_c}$$

$$\Omega=\frac{\hat{M}}{\hat{O}}$$

and then

$$\lambda'=1-\frac{\Omega}{P}$$

On the other hand, Chart 4 draws the changes in $P_E$ and $P_c$. According to this there is a difference in the timing in these curves resulting in the change of $p$. In particular, the sharp decline of $p$ in the latter half of the 1910's as shown in Chart 3 was caused by the fact that the increase of $P_c$ happened about 2 years before the increase of $P_E$. It is worthy of special attention that the period roughly from 1911 to 1914 when $p$ showed a high level was, generally speaking, depression and the period from 1917 to 1920 was a boom period. In other words, the relative price rose in depression and sagged in boom periods. This is because, in contrast with the electricity price which fluctuates comparatively little, the coal price changes rapidly showing a gain in boom days and a decline in depression.

Chart 3 shows the movement of and $p$ and $\Omega$. Let us pay attention first to the movement of $\Omega$. This showed a straight forward decline until around 1930 without practically any change. The decline of $\Omega$ is caused by the increase of hydraulic generation and the increase of the efficiency of steam power generation itself. However, $\Omega$ started to rise a little from 1930 and became stable after several years. The reason why it started to rise in 1930 is the increase in hydraulic generation during this period.

In the last formula, the decrease in $\Omega$ means the increase of $\lambda'$. However, as a matter of fact $\lambda'$ decreased.[10] Also, $\Omega$ did not show any remarkable cycle until 1930. However, even during this period a clear cycle is noticed in $\lambda'$. Thus $\Omega$ can not be taken as a dominant factor for explaining the change in $\lambda'$.

This fact naturally indicates that the change in $\lambda'$ depends considerably on the change in $p$. As a matter of fact, if a comparison is made between $\lambda'$ and $p$, the pattern of changes in both corresponds with each other very well, not only from a long-run but also from a short-run viewpoint.

Thus we have found from the above analysis that the increase in the so-called capital cost represented by the interest cost and the depreciation cost was one of the causes for the long-run decrease in the income ratio, and that the decrease of the relative price of electricity to coal was its dominant cause. We have further found that the short-run change in the income ratio can be decisively explained by the change in the relative price.[11]

## IV. *Analysis of Income Distribution*

In this section, we intend to see how income distribution[12] for labor and capital have changed. In this connection it is defined that the relative share of labor and capital, namely $R_L$ and $R_K$ are, respectively, the percentages of paid wages $W$ (including salaries) and profit $Q$ to $X$.

$$R_L=\frac{W}{X}$$

$$R_K=\frac{Q}{X}$$

Chart 5 indicates the process of $R_L$. $R_L$ shows a tendency of being almost stable or going down a little from the long-run viewpoint, and an extremely clear cycle of about 10 years is recognized from the short-run viewpoint.

$R_L$ can be divided into the wage cost ratio $E$ and the income ratio $\eta$ as follows

10 The rise of $\Omega$ after 1930 is, however, causing the rapid decrease of $\lambda'$ during that period.

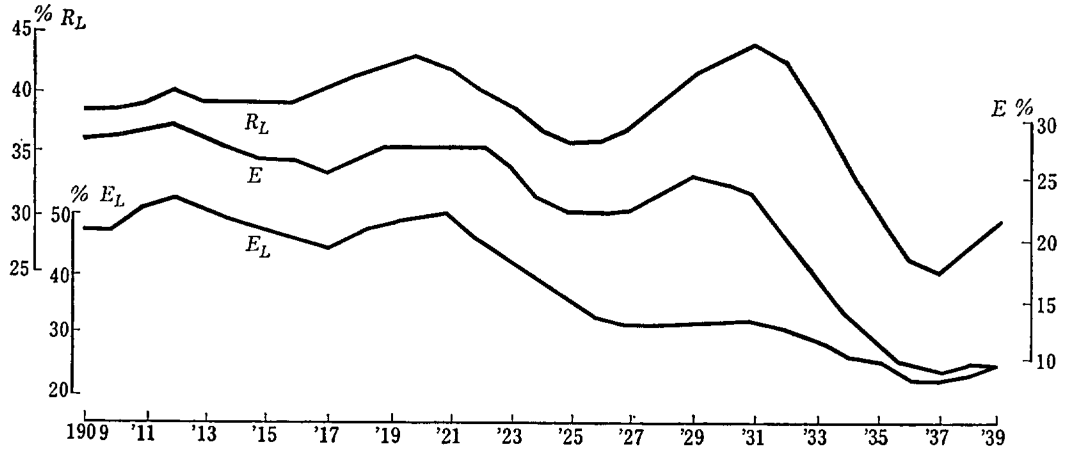
11 An equation of the income ratio and relative price is measured as follows;

$$\eta=49.01342+77.37193\log p \qquad r^2=0.82379$$
$$(3.65690)^*$$

M. Shinohara has suggested one hypothesis concerning the movement of the income ratio. This is to the effect that the decrease of the income ratio is predominantly caused by the decrease of the relative price of products to material. This hypothesis is applicable as it is to the electric supply industry. Miyohei Shinohara, *Income Distribution and Wage Structure*, (in Japanese) Tokyo, 1955, p. 92.

12 If the relative share of labor is compared between the electric supply industry and other industries using the estimates by M. Shinohara, it can be seen that the figure is rather low. This is intimately related with the fact that the profit rate of this industry is extremely high. M. Shinohara, *op. cit.*, pp. 52–3.

CHART 5. THE MOVEMENTS IN RELATIVE SHARE OF LABOR ($R_L$), WAGE COST RATIO ($E$) AND PRODUCTION ELASTICITY OF LABOR ($E_L$)




$$R_L=\frac{W}{\eta O}=\frac{E}{\eta}$$

Here $$E=\frac{W}{O}$$

Therefore $$E=\frac{\hat{W}}{\hat{O}}$$

$E$ indicates the wage cost which is necessary for producing a unit of electricity.

Now let us compare the movement of $R_L$ with that of $\eta$. From the long-run viewpoint $\eta$ is going down, but no rising trend of $R_L$ can be found. The short-run change in $R_L$ does not necessarily correspond to the reciprocal of $\eta$. The peak of $R_L$ more often corresponds to the peak of $\eta$. Thus it can be said that the change in $R_L$ has practically no relationship with the change in $\eta$.

Next, let us compare $R_L$ with $E$. At one glance, it can be seen that there is an intimate relationship between the two. The long-run decrease of $R_L$ is explained by the decrease of $E$ and the cycle seen in $R_L$ is clearly explained by the cycle of $E$. The reason why $R_L$ did not rise in spite of the long-run decrease of $\eta$ is because there was a rapid decrease of $E$ which was more remarkable than the decrease in $\eta$. The big decline of $\eta$ in the 1930's was offset by the even faster decrease of $E$ and as a result $R_L$ decreased considerably.

In other words, the change in the condition of how much wage expenses are required for producing a unit of electricity was the controlling factor in the movement of income distribution in this industry.[13]

The analysis of the change in the relative share of labor is, if looked at the other way round, nothing but the analysis of the relative share of capital $R_K$.

In the definition of $R_K$, both the denominator and the numerator are deflated by $P_E$ as follows;

$$R_K=\frac{\hat{Q}}{\hat{X}}$$

From this

$$R_K = \frac{\hat{Q}}{\hat{K}} \cdot \frac{\hat{K}}{\hat{X}}$$

is obtained.

The first term of the right side is the real profit rate $\hat{\rho}$ and the second term is the capital coefficient $\hat{C}$.

$$R_K = \hat{\rho} \cdot \hat{C}$$

The movements of $R_K$, $\hat{\rho}$, $\hat{C}$ are shown in Chart 6. According to this, $\hat{\rho}$ decreases in the long-run. In particular, it is noteworthy that the profit rate which was more than 25% in 1909 decreased to less than 15% within the next 5 years.

On the other hand, $\hat{C}$ has increased in the long-run; the capital stock required for producing one unit of electricity has increased. This is the result of the increase in hydraulic generation with its huge equipment.

$\hat{\rho}$ has decreased and $\hat{C}$ has increased in the long-run. As a result, $R_K$ is almost stable in its trend. Next, short-run cycles noticed in $\hat{\rho}$ and $\hat{C}$ are in a reverse relationship. In other words, when $\hat{\rho}$ is high, $\hat{C}$ is low whereas when $\hat{\rho}$ is low, $\hat{C}$ is high. This fact shows that, since $\hat{C}$ is the reciprocal of the average productivity of capital, there is a mutual relationship between the average productivity of capital and the profit rate both from the long-run and the short-run viewpoint.[14] In spite of the above, $R_K$ is showing a short-run cycle reflecting the movement of $\hat{\rho}$.

[13] It can be said that the wage cost ratio indicates the productive efficiency of labor. If it is possible to consider that the wage cost ratio has such an economic meaning, the result will be that the movement of the relative share of labor has been controlled by the movement of the productive efficiency of labor. The direct index showing the productive efficiency of labor is, of course, the production elasticity of labor $E_L$

$$E_L = \frac{\partial \hat{X}}{\partial L} \Big/ \frac{\hat{X}}{L}$$

This value can easily be obtained using the productivity function calculated in footnote 3. Two productivity functions have been calculated. If $E_L$ is obtained from the last one among them,

$$E_L = 1 - 0.88795\left(1 - \frac{0.2}{\hat{x}}\right).$$

If the value of $\hat{x}$ is substituted, the yearly series of $E_L$ can be calculated. The result is in Chart 5. As is clear at a glance, there is an intimate relationship between $R_L$ and $E_L$. The decisive coefficient ($r^2$) is 0.42935 and meaningful at the significance level of 5%.

[14] In the above footnote, it has been shown that $R_L$ can be well explained by $E_L$. This means that $R_K$ can be explained by the production elasticity of capital $E_K$.

Since $E_K = \frac{\partial \hat{X}}{\partial \hat{K}} \Big/ \frac{\hat{X}}{\hat{K}} = \frac{\partial \hat{X}}{\partial \hat{K}} \cdot \hat{C}$

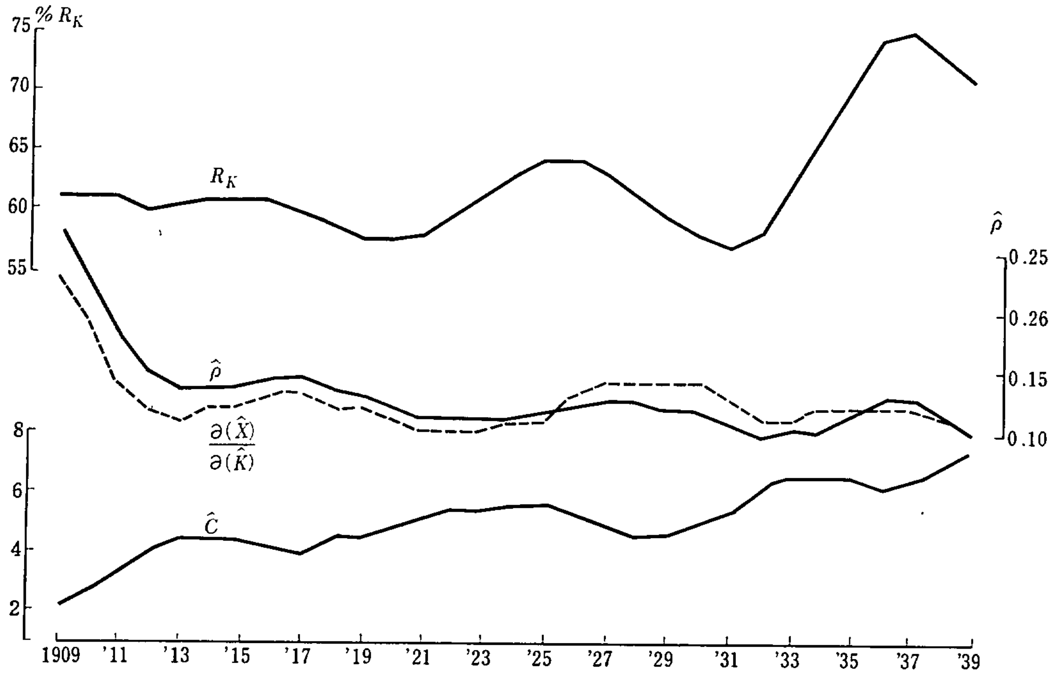
and $R_K = \hat{\rho} \cdot \hat{C}$

the relationship between $R_K$ and $E_K$ means the relationship between $\hat{\rho}$ and the marginal productivity of capital. Therefore, $\hat{\rho}$ should be explained by $\frac{\partial \hat{X}}{\partial \hat{K}}$. The marginal productivity of capital can be obtained from the above mentioned productivity function.

$$\frac{\partial \hat{X}}{\partial \hat{K}} = 0.88795\left(\frac{1}{\hat{C}} - \frac{0.2}{\hat{k}}\right)$$

By substituting the date of $\hat{k}$ and $\hat{C}$, the series of $\frac{\partial \hat{X}}{\partial \hat{K}}$ can be calculated. The result is shown in Chart 6. A clear relationship between this and $\hat{\rho}$ is noiiced. Therefore, it can not be denied that there was the decrease of the marginal productivity of capital at the back of the decrease of the profit rate.

CHART 6. THE MOVEMENTS IN RELATIVE SHARE OF CAPITAL ($R_K$), PROFIT RATE ($\hat{\rho}$), CAPITAL COEFFICIENT ($\hat{C}$) AND MARGINAL PRODUCTIVITY OF CAPITAL $\left(\frac{\partial \hat{X}}{\partial \hat{K}}\right)$




In other words, the reason why $R_K$ was steady from the long-run viewpoint was that the profit rate and the capital coefficient moved in reverse directions or the profit rate and the average productivity of capital moved in the same direction, and also the short-run movement of $R_K$ was mostly caused by the movement of the profit rate.

In the above, the change in relative share has been analysed from two directions, one from labor and the other from capital.

In short, the long-run stability of the relative share has been explained by the reverse movements of the income ratio and the wage cost ratio and also by the reverse movements of the profit rate and the capital coefficient. It is rather difficult to pass judgement on which of the two is more decisive. However, it seems that the latter explanation is more logical.

We have found that the short-run movement of the relative share can not be explained by the movements of the income ratio and the capital coefficient. That depends mostly on the movements of the wage cost ratio and the profit rate. For instance, the rise of $R_L$ (decrease of $R_K$) is explained by either the rise of the wage cost ratio or the decrease of the profit rate. Since the wage cost ratio and the profit rate move in reverse directions in principle, the two explanations for the short-run movement of relative share are after all the same thing.

## V. *Concluding Remarks*

In the above, the growth process of the electric supply industry has been analysed from three different aspects.

The first analysis is concerned with production. Hereupon the pattern of the growth rate in output and input has been compared and examined, and it has been pointed out that the movement of the growth rate of output corresponds very much to the business cycle, and also there is a clear cycle in the growth rate of input. It has also been found that there is an intimate relationship between the growth rate of productivity and that of capital intensity.

The second analysis is concerned with the movement of the income ratio. This was explained by the movements of the relative price of electricity to coal. In boom days, coal price goes up considerably and the relative price goes down, and vice versa. Therefore, in boom days the income ratio decreases and in depression it goes up.

The third analysis is concerned with income distribution. In this connection, the analysis was made from two directions, one from the relative share of labor and the other from the relative share of capital. It has been indicated that the long-run stability of the relative share can be explained by the reverse movements of the wage cost ratio and the income ratio or the reverse movements of the profit rate and the capital coefficient. It has been made clear that the short-run movements of the relative share is mostly caused by the movements of the wage cost ratio and the profit rate.